Excitation continuum near a phase transition point in $Na_3Co_2SbO_6$

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The exactly solvable Kitaev honeycomb model has attracted considerable research interest in recent years. Its ground state is a quantum spin liquid, along with fractionalized excitations which have promise for topological quantum computation. Recently, in a candidate material $Na_3Co_2SbO_6$, we observed a gapless continuum of excitations near **q**=0 below 1 meV, near a transition field between antiferromagnetic (AFM) and field-polarized states. Our previous time-of-flight inelastic neutron scattering (INS) results are shown in Fig. 1. The base temperature of the spectrometer we used (4SEASONS, J-PARC) was 3.5 K, which is relatively high compared to the AFM characteristic temperature T_N = 7 K. To rule out thermal broadening, we have measured the sample on HODACA down to 50 mK using a dilution cryostat, and the same continuum of excitations, with the momentum-integrated intensity being an approximately linear function of energy, is observed.

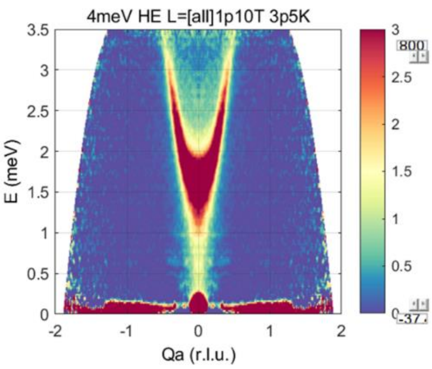

Fig. 1. INS spectrum of $Na_3Co_2SbO_6$ in 1.1 T magnetic field at 3.5 K, measured at 4SEASONS, J-PARC. A continuum excitation is observed near **q**=0 below 1 meV.

The continuum is measured on HODACA in a *b*-axis field of 1.14 T, subtracting the 0 T results as background. The results at each energy transfer are displayed in Fig. 2, which we fit with a Gaussian peak (width limited by resolution) centered at **q**=0. As shown in Fig. 3, the intensity of the excitations at 1.14 T is proportional to the energy transfer (except at 0.3 meV, which reaches the limit of HODACA). Results obtained at a higher temperature of 1.7 K are similar, which indicates the robustness of the continuum. In contrast, the signals at 1.3 T are different, as they arise from regular spin waves.

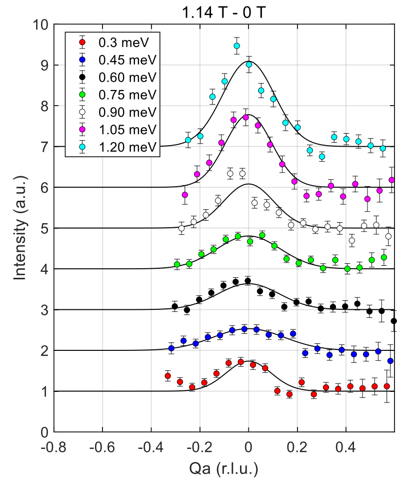

Fig. 2. Scans along Qa (horizontal axis in Fig. 1) at different energies at 1.14 T and 50 mK, subtracting 0 T data as background. The data are fitted with a Gaussian peak at Qa=0 (of the same width for all the data) and offset for clarity.

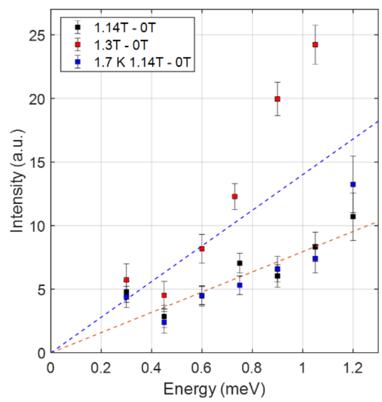

Fig.3. Intensity of continuum at different energy. The 1.14 T data at both 50 mK (blue) and 1.7 K (black) exhibit linear behavior, different from the data at 1.3 T (away from the critical point).